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A mismatch between population health literacy and the complexity of health information:

an observational study

Abstract

Background

Low health literacy is associated with poorer health and higher mortality. Complex health materials are a barrier to health.

Aim

To assess the literacy and numeracy skills required to understand and use commonly used English health information materials, and to describe population skills in relation to these.

Design and setting

An English observational study comparing health materials with national working-age population skills.

Method

Health materials were sampled using a health literacy framework. Competency thresholds to understand and use the materials were identified. The proportion of the population above and below these thresholds, and the sociodemographic variables associated with a greater risk of being below the thresholds, were described.

Results

Sixty-four health materials were sampled. Two competency thresholds were identified: text (literacy) only, and text + numeracy; 2515/5795 participants (43%) were below the text-only threshold, while 2905/4767 (61%) were below the text + numeracy threshold. Univariable analyses of social determinants of health showed that those groups more at risk of socioeconomic deprivation had higher odds of being below the health literacy competency threshold than those at lower risk of deprivation. Multivariable analysis resulted in some variables becoming non-significant or reduced in effect.

Conclusion

Levels of low health literacy mirror those found in other industrialised countries, with a mismatch between the complexity of health materials and the skills of the English adult working-age population. Those most in need of health information have the least access to it. Efficacious strategies are building population skills, improving health professionals' communication, and improving written health information.

Keywords

health information; health literacy; numeracy; primary care; public health.

INTRODUCTION

Health literacy skills are 'the motivation and ability of individuals to access, understand, and use information in ways which promote and maintain good health'.¹ The most fundamental skills are those 'needed ... to function in everyday (health) situations to access and use information'.² Low health literacy is associated with greater use of medical services, less preventive care, greater difficulty managing long-term illnesses,³ lower levels of health,³⁻⁵ and higher mortality in older people.^{3,4} Levels of health literacy have been surveyed in several industrialised countries, that is, the US, Canada, Australia, and the EU, with the prevalence of low health literacy varying from 29% to 62%.⁵⁻⁸

Health texts are written at levels that exceed average public readings skills.^{9,10} Finding ways to reduce the mismatch between population skills and health material complexity has been identified as a priority by the US government.¹¹

This study sought to explore health literacy skills in an English setting, bringing together expertise from clinical practice, public health, and education. The objectives were to assess a range of health materials; to determine the threshold of health literacy

and numeracy skills needed to understand and use these; and to describe the English working-age population in relation to these thresholds.

METHOD

Health materials in England were purposively sampled using a framework developed to capture literacy and numeracy skills needed to become and stay healthy.¹² This framework has been used in several national health literacy surveys.⁶⁻⁸ Suitable topics within framework areas (for example, within health promotion: how to maintain a healthy weight) were discussed and agreed by the research team. Materials from topics within each framework area were independently sampled. All items were nationally publicly available in health and public libraries or via the internet. The framework, with examples and chosen subjects, is shown in Box 1.

The sampled materials were independently assessed by external experts, that is, people at a senior level (consultant or equivalent) in areas of relevance to health literacy. Health trainers (non-clinical workers providing self-management advice and signposting) were included. Prior knowledge of health

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How this fits in

Low health literacy is associated with lower levels of health, higher risk of long-term conditions, more difficulty managing conditions, and, in older people, higher mortality. This study explored the extent to which the level of literacy and numeracy required to understand and use health information in England matched the literacy and numeracy skills of the population. A significant proportion of the population did not have the skills to fully understand and use the health materials sampled. A rigorous approach should be taken to develop more accessible health information, and further research should explore the health and economic impact of low health literacy in England.

literacy was not required. Experts were approached through the UK health literacy group, a national group of researchers, practitioners, and patient groups,¹³ via an email to members with an NHS email. Experts were also recruited through local

contacts in London and Manchester. Fifty-two experts were approached, of which 33 (63%) agreed to participate. They consisted of seven nurses, six GPs, six hospital consultants, five dietitians/nutritionists, two NHS managers, two road safety experts, two health trainers, two health promotion experts, and one public health consultant.

Experts were asked whether the materials represented those in everyday use, the frequency with which people would be exposed to the material, and the potential impact of failure to understand and use the information. They were asked to identify areas where additional material should be sampled. Additional sampling and assessment followed the same protocol. Views were gathered through a web-based survey.

All the materials were assessed for their literacy and numeracy complexity using the English National Qualifications Framework (NQF)¹⁴ by education experts external to the study team (Box 2).

Education reviewers assessed the level of skill required to understand and use the materials. These were graded up to and including level 2, the level expected to be achieved by age 16 years; materials above this level were grouped with level 2. Each item was assessed by one reviewer using standard criteria for the NQF. Areas of ambiguity, or where assessment was 'borderline' between skills levels, were highlighted and discussed. The materials were not tested directly with SFL 2011 participants. Data on skills were taken directly from *The 2011 Skills for Life Survey* (SFL 2011) data. Further details are available from the authors.

Population health literacy competency

A competency threshold of 70% was adopted, reflecting usual English practice, and similar to the US threshold of 67%.¹⁵ This made allowances for testing errors, assumed that understanding most health materials would be sufficient for 'competency', and mitigated against chance sampling of overly complex materials.

Each item was coded and a basic and cumulative frequency of the number of materials at each skills level tabulated, weighted according to expert health panel assessments. The proportion of the population above and below these competency thresholds were derived from SFL 2011 (Box 3).¹⁶

SFL 2011 data were weighted to ensure they were representative of the English resident working-age population. Statistical analyses were undertaken using IBM PASW

Box 1. Health materials sampling framework

Health activities	Focus	Examples of materials	Examples of tasks	Subject areas
Health Promotion	Enhance and maintain health	<ul style="list-style-type: none"> Charts, graphs, lists Food and product labels 	<ul style="list-style-type: none"> Purchase food Plan exercise regimen 	<ul style="list-style-type: none"> Healthy weight
Protecting personal and public safety	Safeguard health of individuals and communities	<ul style="list-style-type: none"> Health and safety warnings Air and water quality reports 	<ul style="list-style-type: none"> Decide between product options Use/avoid products 	<ul style="list-style-type: none"> Road safety Home safety
Disease prevention	Take preventive measures and engage in early detection	<ul style="list-style-type: none"> Postings for inoculations and screening Letters related to test results Graphs, charts 	<ul style="list-style-type: none"> Determine risk Engage in screening or diagnostic tests Follow-up 	<ul style="list-style-type: none"> Men's health Cancer screening Reduction in harmful lifestyle activities Vaccination
Managing illness	Seek care and form a partnership with healthcare providers	<ul style="list-style-type: none"> Health history forms Medicine labels Discharge instructions Education booklets and brochures 	<ul style="list-style-type: none"> Describe and measure symptoms Follow directions on medicine labels Collect information on merits of various treatment regimens for discussion with health professionals 	<ul style="list-style-type: none"> Diabetes mellitus Medication instructions
Systems navigation	Access needed services	<ul style="list-style-type: none"> Maps Application forms Statements of rights and responsibilities Informed consent 	<ul style="list-style-type: none"> Locate facilities Apply for benefits Offer informed consent 	<ul style="list-style-type: none"> Which services to access when acutely unwell, and how to access them

Box 2. English National Qualifications Framework (NQF)

Level	English NQF age equivalent	Literacy An adult classified at the level understands	Numeracy An adult classified at the level understands	Examples of typical skills
Entry 1	5–7 years	<ul style="list-style-type: none"> Short texts with repeated language patterns on familiar topics Information from common signs and symbols 	<ul style="list-style-type: none"> Information given by numbers and symbols in simple graphical, numerical, and written material 	<ul style="list-style-type: none"> Write short messages Select floor numbers in lifts
Entry 2	7–9 years	<ul style="list-style-type: none"> Short straightforward texts on familiar topics Information from short documents, familiar sources, signs, and symbols 	<ul style="list-style-type: none"> Information given by numbers, symbols, simple diagrams, and charts in graphical, numerical, and written material 	<ul style="list-style-type: none"> Describe health symptoms Use a cashpoint machine
Entry 3	9–11 years	<ul style="list-style-type: none"> Short straightforward texts on familiar topics accurately and independently Information from everyday sources 	<ul style="list-style-type: none"> Information given by numbers, symbols, diagrams, and charts used for different purposes and in different ways in graphical, numerical, and written material 	<ul style="list-style-type: none"> Understand price labels Pay household bills
Level 1	Matriculation examinations (GCSE) grade D–G	<ul style="list-style-type: none"> Short straightforward texts of varying length on a variety of topics accurately and independently Information from different sources 	<ul style="list-style-type: none"> Straightforward mathematical information used for different purposes. Independently select relevant information from given graphical, numerical, and written material 	<ul style="list-style-type: none"> GCSE grades D–G
Level 2 or above	GCSE grades A* to C or higher qualifications	<ul style="list-style-type: none"> A range of texts of varying complexity accurately and independently Can obtain information of varying length and detail from different sources 	<ul style="list-style-type: none"> Mathematical information used for different purposes and can independently select and compare relevant information from a variety of graphical, numerical, and written material 	<ul style="list-style-type: none"> 5 grades A* to C GCSE

(version 19), SPSS (version 21), and Stata (version 12). Initial univariable analyses explored the association between low health

Box 3. The Skills for Life 2011 Survey¹⁶

- Conducted between May 2010 and February 2011
- Survey population: all adults aged 16–65 years resident in England
- A figure of 7230 participants purposively sampled to reflect survey population
- Background sociodemographic information followed by a pre-assigned random combination of two of three skills assessments: literacy, numeracy, and information communication technology
- In total, 6049 responders assigned to literacy assessment, 6053 responders assigned to numeracy assessment, 4767 responders assigned to both literacy and numeracy assessments.

literacy and known sociodemographic determinants of health (SDH),^{17,18} that is, age, sex, ethnicity, nativity, first language, qualification level, employment, income, home ownership, and area of residence (Index of Multiple Deprivation)¹⁹ (Box 4).

The study identified a new variable, the 'Access to Information' (ATI) index. The SFL 2011 data included information on access to information sources (books, newspapers, and magazines), frequency of reading, and access to a computer and the internet. The ATI was an unweighted composite score.

Separate analyses were undertaken for literacy-only competency and for literacy + numeracy competency. For each variable, the odds of an individual being in the 'below threshold' group was calculated; odds ratios, with 95% confidence intervals (CIs) and statistical significance ($P < 0.05$), were then calculated, with the group with the lowest odds for being below the threshold being taken as the reference group.

Multivariable logistic regression explored which variables remained significant when all variables were considered together. Adjusted odds ratios, with 95% CIs and statistical significance levels, were then calculated for each variable.

As an observational study, STROBE guidelines were followed.²⁰

The health materials were all publicly available, and the SFL 2011 data were fully anonymised and publicly available. Ethics approval was therefore not required.

RESULTS

Assessment of health materials

Sixty-four health materials were sampled. All contained literacy (text) information, and 50 also contained numeracy information. No materials contained just numeracy information. All sampling framework areas contained both 'text-only' and 'text + numeracy' materials except health promotion, where all items were 'text + numeracy'. Details of the materials, the external expert assessments and weighting are shown in Table 1.

Health material representativeness was rated on a scale of 0 (not representative at all) to 3 (highly representative); mean scores ranged from 1.8 to 2.2. Weighting was calculated by multiplying 'frequency of exposure' by 'potential impact of failure to understand and use the material' (possible range 0–9); scores ranged from 3.6 to 5.0.

Following weighting, 17 (27%) of the text items were at NQF literacy level 1 or below, with 47 (73%) at level 2 or above. The 'text-only' competency threshold was thus level 2. Weighted assessments of numeracy

Box 4. Variables explored in the analysis

Variable	Categories
Sex	Male, female
Age	16–44 years, ≥45 years and over
Ethnicity	White, black and minority ethnic
Nativity (Place of birth)	UK, outside of UK
First language	English, other
Qualification level	National Qualification Framework (NQF) at or above the level expected by age 16 years (level 2), NQF below level 2
Employment status	Employed, not employed
Job status	National Statistics Socioeconomic Classification 3 bands
Gross individual income	≥£10 000, <£10 000
Home ownership	Owns or part-owns home, does not own home
Area deprivation (Index of Multiple Deprivation score)	Quintiles

components showed that 20 (39%) were at entry level 3 or below, and 30 (60%) were at level 1 or above. The numeracy competency threshold was therefore level 1.

Thus two competency thresholds were identified; text-only materials (literacy level 2), and text + numeracy materials (literacy level 2 + numeracy level 1).

Population health literacy skills

Analyses were undertaken separately for health literacy (text-only) and health literacy + numeracy. Results for both analyses were similar, therefore only the literacy-only results are presented here; the literacy + numeracy results are available from the author on request.

The characteristics of the sample for the variables analysed for the literacy threshold are shown in Table 2. Collection of data on participant characteristics and skills

assessments were carried out as part of the SFL 2011 survey.¹⁶ Of those who took the literacy assessments, 2515/5795 (43%) were below the text-only competency threshold. The levels of missing data, and the numbers of participants who failed to complete the tests, was low.

The characteristics of the sample for the variables analysed for the literacy + numeracy threshold, including missing data, are available from the author on request. Of those who took both the literacy and numeracy assessment, 2905/4767 participants (61%) were below the literacy + numeracy competency threshold. The levels of missing data, and the numbers of participants who failed to complete the tests, was low.

Univariable and multivariable analyses

The unadjusted (univariable) and adjusted

Table 1. Health materials sampled

Health activities	Material type			Are these materials representative of those in everyday use? Mean score ^a	How many patients would be exposed to this material? Mean score ^b	What is the potential impact of failure to understand this material? Mean score ^c	Weight (frequency of exposure x potential impact) Range 0–9 ^d
	Text only	Text + numeracy	Total				
Health promotion	0	13	13	1.8	1.8	2.0	3.6
Protecting personal and public safety	4	10	14	2.0	1.9	2.6	4.9
Disease prevention	2	10	12	2.1	2.0	2.0	4.0
Managing illness	3	12	15	2.2	2.0	2.4	4.8
Systems navigation	5	5	10	2.1	2.1	2.2	4.6
Total	14	50	64				

^a0 = not at all; 1 = slightly; 2 = moderately; 3 = highly. ^b1 = a few; 2 = many; 3 = most. ^c1 = low; 2 = medium; 3 = high.

Table 2. Literacy competency descriptive analyses

Category	Below competency threshold % (n below/n total)	Skills test not completed/ not recorded, n
All	43 (2515/5795)	255
Sex^a		
Female	41 (1197/2907)	137
Male	45 (1317/2887)	118
Age, years^a		
16–44	57 (1439/3500)	149
45–65	43 (1074/2292)	106
Ethnicity^a		
White	41 (2032/4996)	206
Black and minority ethnic	61 (481/795)	49
Nativity^a		
Born in UK	41 (2010/4953)	189
Not born in UK	60 (504/842)	66
First language^a		
English	40 (2102/5200)	203
Other than English	69 (412/594)	52
Qualification level^a		
5 grade A–C GCSE or above	25 (569/2306)	199
Below 5 grade A–C GCSE	56 (1945/3488)	56
Employment^a		
In work	39 (1582/4061)	184
Not in work	54 (932/1733)	71
Job grade^a		
Managerial/professional	28 (602/2158)	95
Intermediate	43 (438/1014)	18
Routine/manual/ students/unemployed	56 (1474/2622)	142
Income^b		
≥£10 000	20 (806/4015)	94
<£10 000	96 (1708/1779)	161
Home ownership^b		
Owns or part-owns home	35 (1251/3593)	155
Does not own home	57 (1263/2202)	100
Area deprivation^a		
0–9 (least deprived)	29 (362/1233)	44
10–19	38 (733/1906)	87
20–29	44 (460/1036)	42
30–39	55 (406/737)	30
≥40 (most deprived)	64 (553/862)	52
Access to information score^a		
≥9 (high access)	27 (499/1881)	72
5–8	44 (1208/2725)	119
<5 (low access)	68 (807/1187)	64

Variable data missing (not entered or declined): ^an = 0–10, ^bn = 10 to 20.

(multivariable) odds ratios for the variables studied are shown in Table 3. The results for the literacy + numeracy analysis are available from the author on request.

All the demographic, educational, and economic variables were related to competency, with odds ratios around 2 before adjustment. For both literacy-only competency and literacy + numeracy competency, those groups more at risk of socioeconomic deprivation (that is, minority

ethnic groups, those born outside the UK, without English as a first language, highest level of qualification below that expected by age 16 years, not in work, in low-grade work, with a low income, and non-home owners) had significantly higher odds of being below the health literacy competency threshold when compared with groups at lower risk of socioeconomic deprivation. Older people (45–65 years) had higher odds of being below the health literacy competency threshold (text-only) than younger people (16–44 years). Sex showed a different direction for literacy-only (males had higher odds of being below the threshold) compared with literacy + numeracy (females had higher odds of being below the threshold).

After adjustment, being born in the UK and not being in work were not significant; the effect of several other predictors remained statistically significant but was reduced.

The ATI index showed that those below the competency thresholds had significantly lower access to potential sources of health information in both unadjusted and adjusted analyses.

DISCUSSION

Summary

Sixty-four examples of health materials were sampled across five health activity areas. All 64 contained literacy (text) information, while 50 also contained numeracy information. No materials contained just numeracy information. The materials were written at a level of complexity above the skills of a significant proportion of the English working-age population. Of the 5795 participants who had completed the literacy skills tests, 2515 (43%) were below the text-only competency threshold, while of the 4767 people who had completed both the literacy and numeracy skills assessments, 2905 (61%) were below the literacy + numeracy competency threshold.

Analysis of SDH showed that all were highly statistically significantly associated with greater odds of being below the competency thresholds; the exception being age (literacy + numeracy competency). While not all variables remained in the multivariable models, both models showed strong associations with SDH, with those already at risk of lower health through SDH also being at higher risk of low health literacy. Those with the most need for access to health information, that is, those below the competency thresholds, therefore had the least access to it.

Table 3. Literacy competency univariable and multivariable analyses

Category	Unadjusted odds ratio	95% CI	P-value	Adjusted odds ratio	95% CI	P-value
Sex						
Female (ref)						
Male	1.20	1.08 to 1.33	<0.001	1.25	1.09 to 1.43	0.001
Age, years						
16–44 (ref)						
45–65	1.26	1.14 to 1.40	<0.001	1.44	1.25 to 1.67	<0.001
Ethnicity						
White (ref)						
Black minority ethnic	2.23	1.92 to 2.60	<0.001	1.43	1.09 to 1.87	0.008
Nativity						
Born in UK (ref)						
Not born in UK	2.18	1.88 to 2.53	<0.001	1.07	0.75 to 1.51	0.719
First language						
English (ref)						
Other than English	3.34	2.78 to 4.00	<0.001	2.03	1.39 to 2.97	<0.001
Qualification level						
≥2 (ref)						
<2	3.85	3.43 to 4.32	<0.001	2.38	2.04 to 2.77	<0.001
Employment						
Employed (ref)						
Not employed	1.82	1.63 to 2.04	<0.001	1.05	0.88 to 1.25	0.551
Job grade						
Managerial/ professional	1.97	1.68 to 2.30	<0.001	1.40	1.18 to 1.71	<0.001
Intermediate (ref)						
Routine/manual/ students/ unemployed	3.32	2.94 to 3.75	<0.001	1.88	1.60 to 2.22	<0.001
Income						
≥£10 000 (ref)						
<£10 000	1.91	1.71 to 2.12	<0.001	1.41	1.19 to 1.67	<0.001
Home ownership						
Owns/part-owns home (ref)						
Does not own home	2.04	1.83 to 2.27	<0.001	1.32	1.13 to 1.60	<0.001
Area deprivation						
0–9 (ref)						
10–19	1.50	1.29 to 1.75	<0.001	1.25	0.97 to 1.60	0.075
20–29	1.92	1.61 to 2.28	<0.001	1.46	1.16 to 1.83	0.001
30–39	2.95	2.44 to 3.57	<0.001	1.58	1.28 to 1.96	<0.001
≥40	4.04	3.37 to 4.85	<0.001	1.94	1.54 to 2.46	<0.001
Access to information score						
≥9 (ref)						
5–8	2.21	1.94 to 2.51	<0.001	1.78	1.51 to 2.11	<0.001
<5	5.89	5.02 to 6.90	<0.001	3.11	2.56 to 3.79	<0.001

Ref = reference.

Strengths and limitations

This study focuses on a key aspect in health literacy: the mismatch between population skills and the complexity of health information materials. It describes a method to evaluate this in England.

The strengths of this study are as follows. Materials were sampled from a wide range of health areas. External experts rated the materials as moderately representative of those in everyday use and felt that clinically significant numbers of patients/the public would be exposed to them, with moderate

impacts on their health should they fail to understand them. The literacy and numeracy competencies were determined from a recent large English national skills survey, purposively sampled to ensure representativeness for the working-age population.

The limitations of this study were as follows. Population skills were measured using tests of a type that, while widely used in national and international surveys, have been criticised for only partially measuring skills, not adequately reflecting different cultures, and not adequately reflecting 'real life'.²¹ However, the health materials used to determine competency thresholds were 'real-life' and representative of the wider range of health materials in everyday use.

This study did not assess important skills such as verbal literacy; however, the area that was examined in this study (the skills to fully understand and use health materials) is undoubtedly a core skill; people below the competency thresholds will have to use other resources, such as face-to-face contacts with health professionals and family and social networks, to gather health information.

The SFL 2011 survey only assessed the skills of the population aged 16–65 years. There are numerous studies showing the impact of low health literacy in older people,^{4,22,23} given cognitive decline with age, and the study's findings of lower health literacy in older people within the cohort in the SFL 2011 survey, it is likely that this group had an even greater unmet need.

Only a small proportion of available materials were sampled, although they were assessed as 'representative' by the study's panel of experts. In addition, locally produced materials not available nationally were not sampled; these may be written at a different level of complexity to those available nationally.

The framework used for sampling the health materials has been used in several national surveys of health literacy levels.^{6–8} While it is fairly comprehensive, the framework does not include health materials to support informed/shared decision making, thus materials in this important aspect of patient care were not sampled.

Because of funding and time limitations, the literacy and numeracy difficulty of health materials was only assessed by one reviewer; although any areas of ambiguity, or where assessment was 'borderline' between two skills levels, were highlighted and discussed. It is possible, therefore, that errors in assessment were not identified and corrected.

Comparison with existing literature

The authors believe that this is the first study to describe a method for measuring the gap between health information complexity and the health literacy skills of the people for whom health information is designed. Despite the different methodology compared with other health literacy surveys, the proportion of the population with low health literacy is similar to that found in other industrialised countries.⁵⁻⁸

Implications for research and practice

In England, health materials are too complex for the skills of a significant proportion of the population, resulting in less access to health information. Further, those who are at the highest risk of poorer health (such as those from black and minority ethnic groups and with low-income, low status jobs) are most likely to have low health literacy. The health information needed by these groups will have to be provided by the NHS as they have the least access to other information sources.

The size and importance of the problem requires awareness and effective solutions.

GPs have a key role through patient care and through their roles as health service commissioners. Rigour should be applied to the development of health materials, to ensure they are written at accessible skills levels. Non-written forms of communication (audio, visual, internet) or use of mobile phone applications could be promoted, particularly for more vulnerable groups.

In the longer-term, the raising of general literacy and numeracy skills through schools and adult education will have health benefits in addition to better life skills.

To date, most health literacy studies have been observational; it is important to develop and test interventions to improve health literacy, and assess the impact on health.³ There have been limited numbers of health economic health literacy studies, with inconclusive results.³ With UK annual health expenditure at £142.8 billion,²⁴ it is important to assess the impact of health literacy on healthcare costs, and to ensure that assessment of health literacy interventions includes an economic evaluation.

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Ethical approval

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Provenance

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Competing interests

The authors have declared no competing interests.

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